Cal Val Telecon
June 5, 2014

# Stennis - Cal val Team
# Update on VIIRS Ocean Color Cal Val
# USM, NRL, QNA, SDSU

1. Tracking the Moby and WavCis
2. Sensitivity of calibration "gains" to ocean color processing in coastal and open waters
3. Banding and striping issues
4. Future Plans
    4. Cruises - Gulf and East Coast

# Constraints

- Jen  2- - 4 slides
- Moby –
  - Data set
  - Step one – constrinta
  - Step 2  = sontraint
  - Step 3 constraint
  - Final data sets  and Gains
- Wavcis SAME

STEPS TO QUALITY CONTROL FOR GAINS

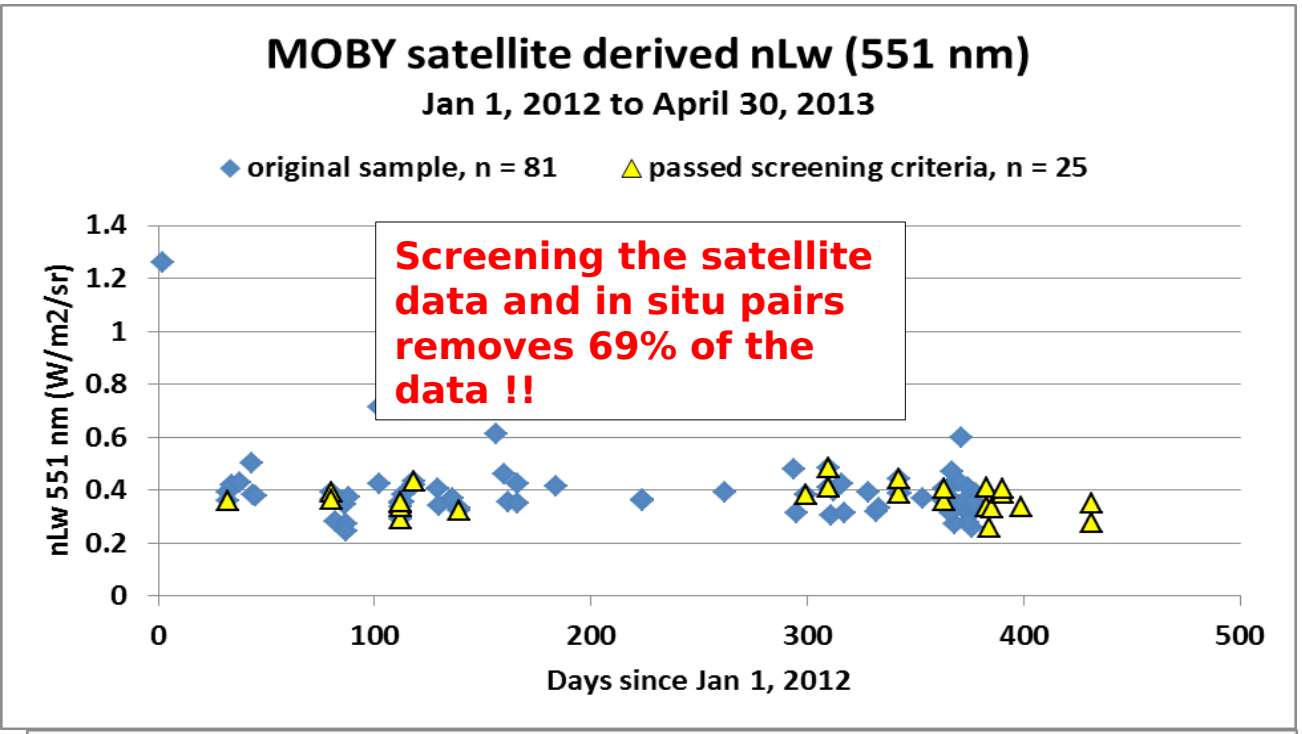
1. **Accumulate coincident matchups (+- 3hrs) of satellite and in situ data (blue markers).**
2. **Apply screening criteria to coincident collections (green and yellow markers).**

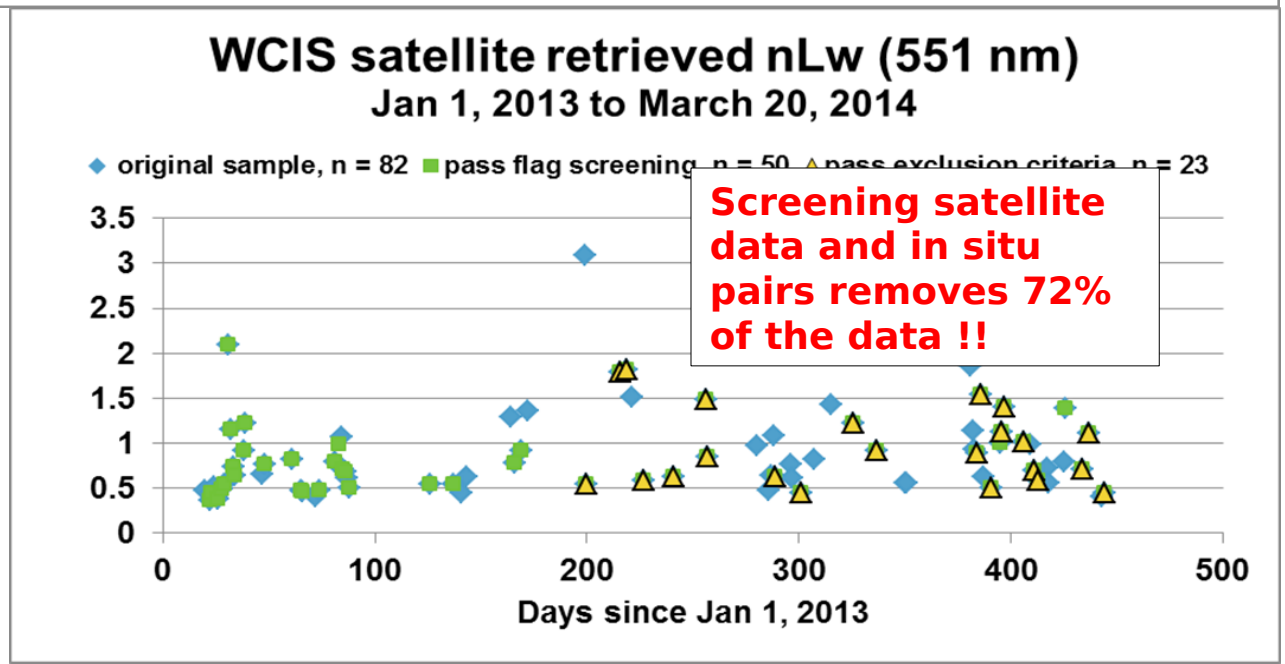
3. **Calculate vLt/Lt for each matchup**
4. **Plot spectral gains and remove anomalies.**
5. **Calculate an average gain for each site: MOBY vicarious calibration and WCIS VGA.**
6. **Apply Vicarious calibration and VGA using APS and look at effects on the nLw retrievals**

7. **Effects of Vicarious Calibration and VGA on chlorophyll products**

## 6. Conclusions:

- The procedure addresses selection criteria for optimizing data quality in a near real-time situation, allowing for vicarious calibration and regional VGA to be established for




1. Accumulate coincident matchups (+- 3hrs) of satellite and in situ data (blue markers).

2. Apply screening criteria to coincident collections (green and yellow markers).

**SCREENING CRITERIA IS CRITICAL!**

As mission average calibrations have been shown to reach stability after 20 – 40 high quality calibration samples[4, 8] consideration is given to balance the strictness of removal criteria and preservation of sample size.

**Vicarious calibration**

**MOBY (*January 2012 to April 2013*)**

Satellite constraints: within 3 hours of over pass and **no** flags allowed on satellite imagery

Exclusion criteria: wind speed must be less than 8 m/s, the maximum aerosol optical thickness (AOT) must be less than 0.2 as measured by the MOBY buoy, the nLw values must be between 0.001 and 3.0, the maximum solar zenith angle = 70 degrees and maximum sensor zenith angle = 56 degrees.

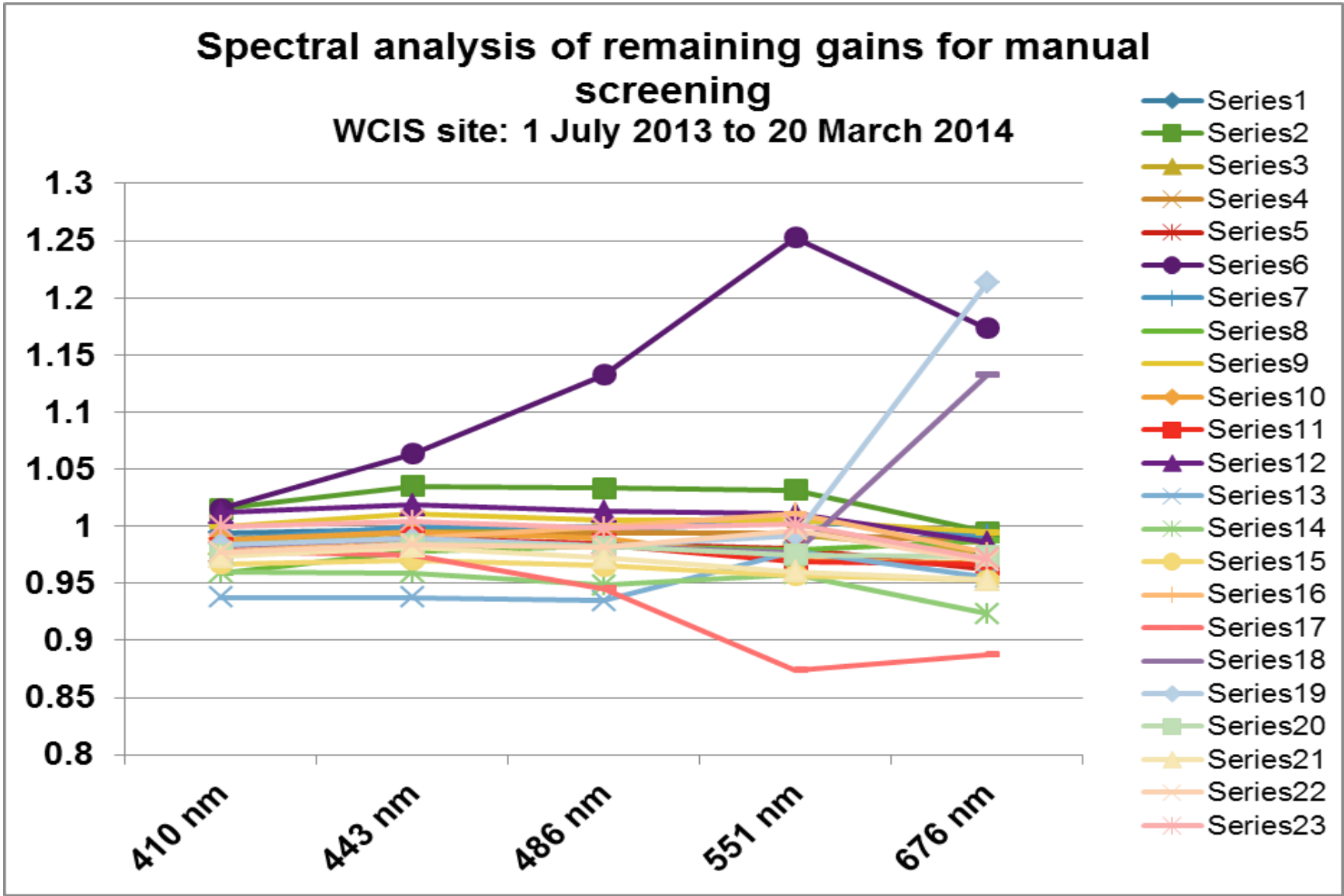
**Regional VGA (*relaxed constraints*)**

**WaveCIS AERONET-OC (Jan 2013 to Mar 2014)**

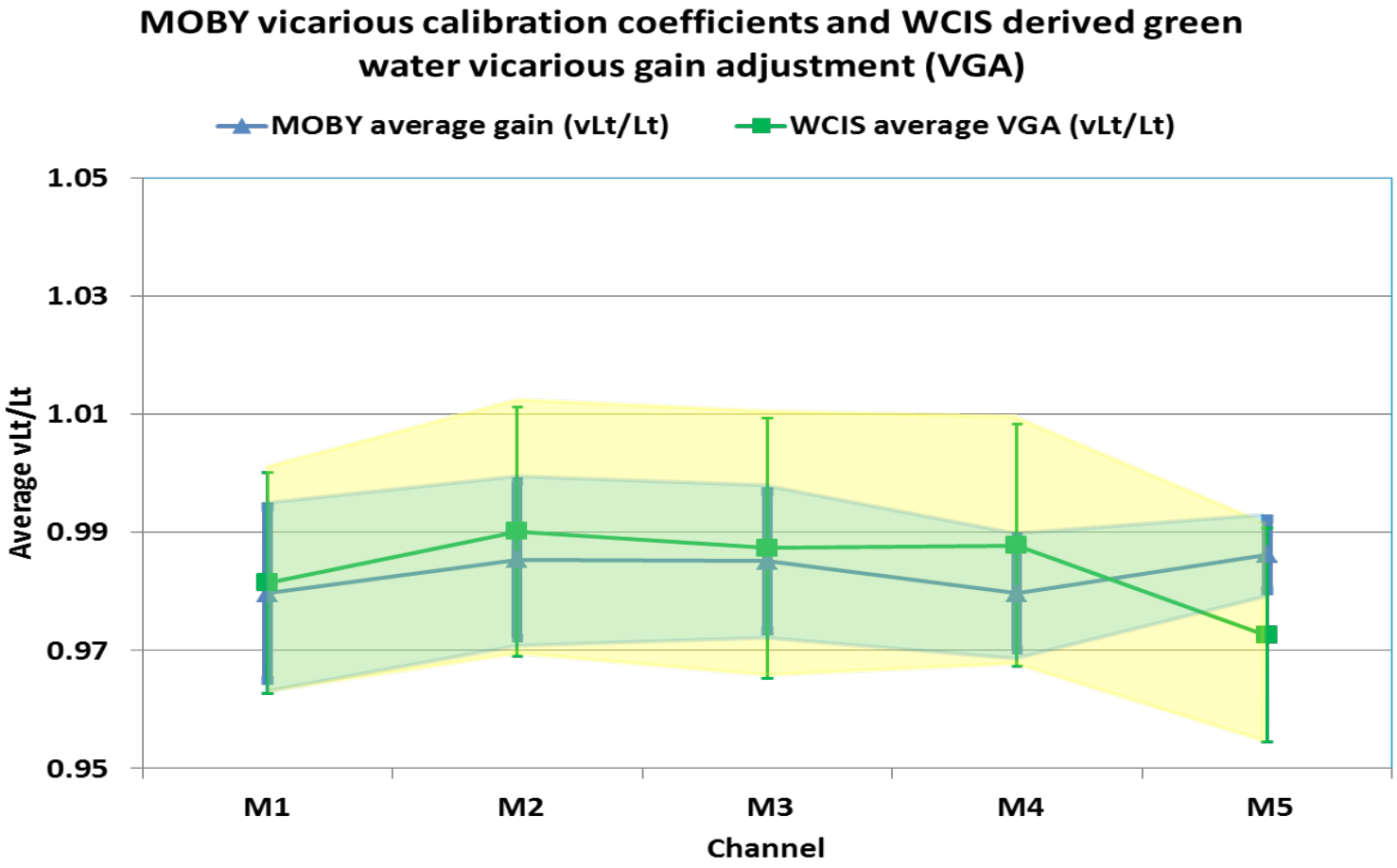
Satellite flags: within 3 hours of overpass, atmospheric failure, failure, cloud/ice, high LT, seaice, high satellite zenith angle, high solar zenith angle, epsilon out of range, high glint, max AER iteration, high polarization, moderate sun glint, and coccolithophores

Exclusion criteria: wind speed must be less than 8 m/s, the maximum aerosol optical thickness (AOT) must be less than 0.2 as measured by the AERONET, the nLw values must be between 0.001 and 3.0, the maximum solar zenith angle = 70 degrees and

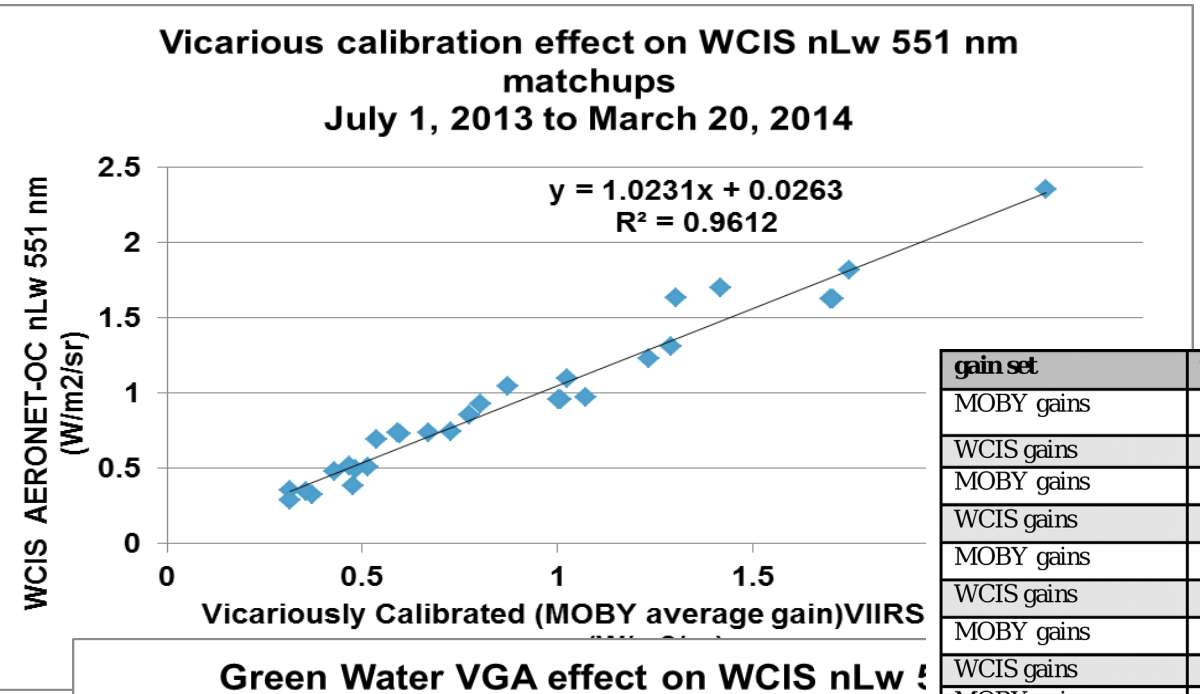
# 3. Plot spectral gains and remove anomalies.

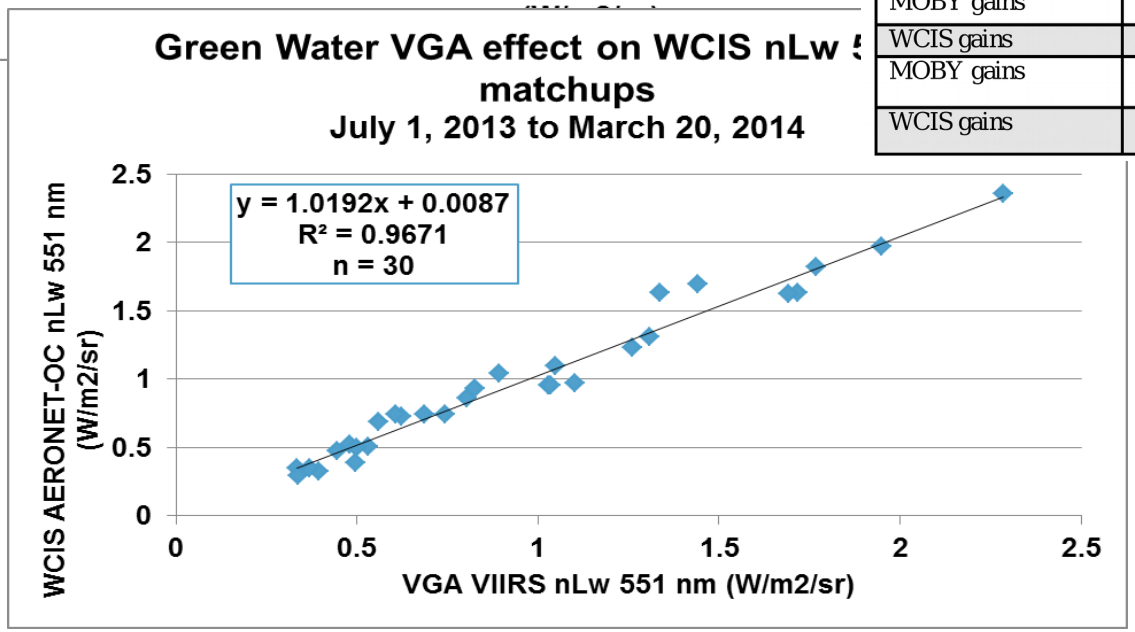


## 5. Calculate an average gain for each site:
## MOBY vicarious calibration and WCIS VGA.

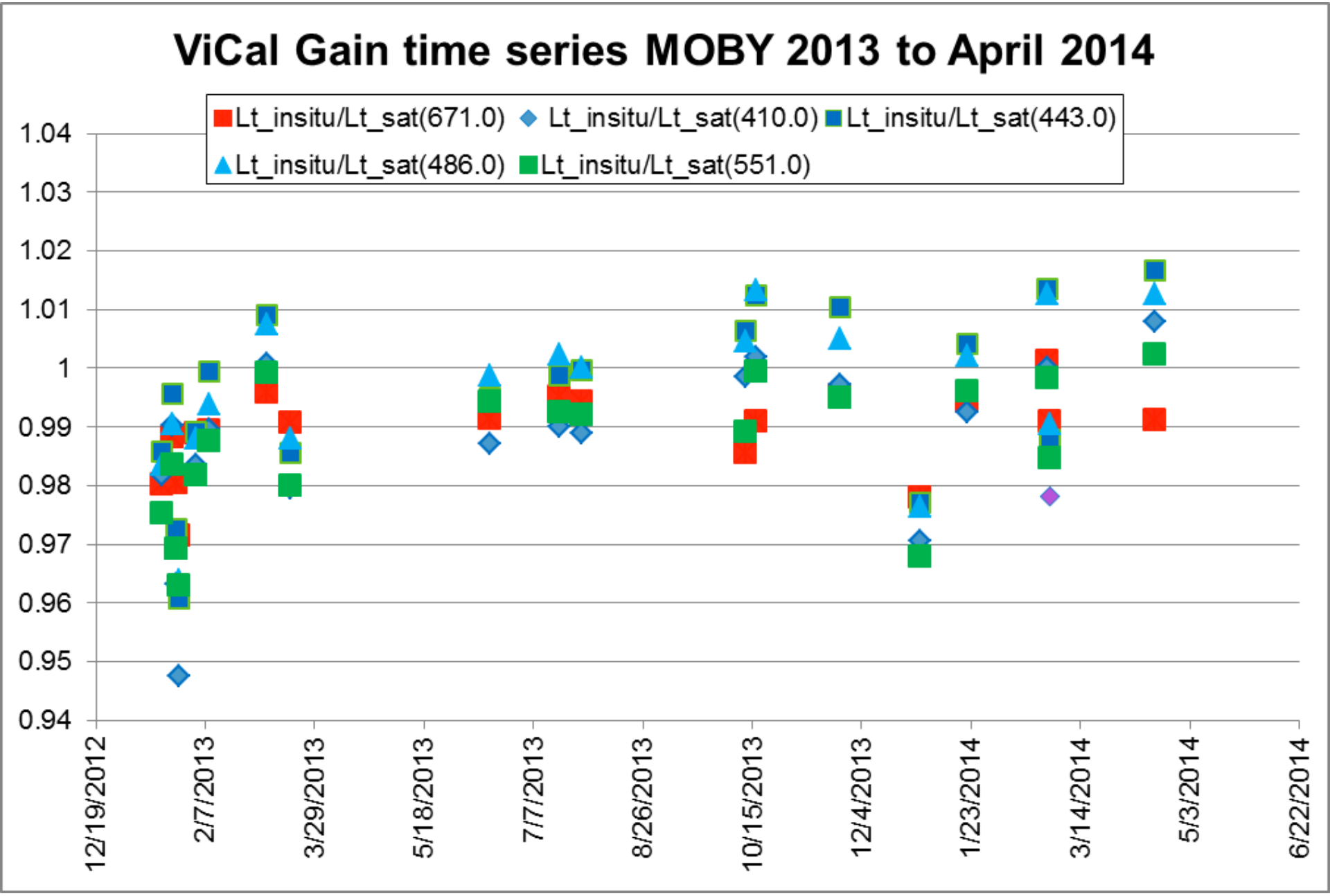


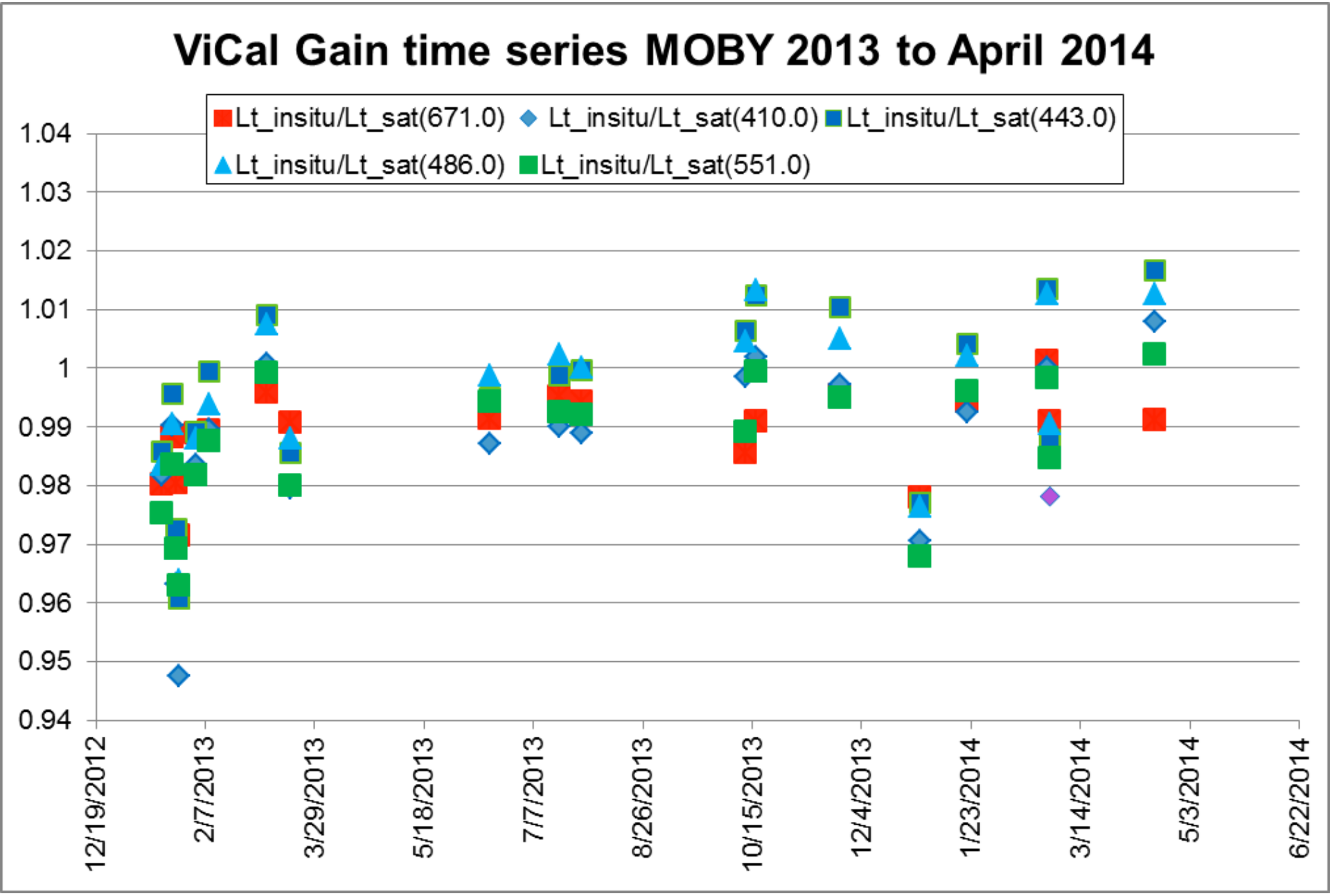
# 6. Apply Vicarious calibration and VGA using APS and look at effects on the nLw retrievals




| gain set | wavelength | regression equation | $R^2$ |
|---|---|---|---|
| MOBY gains | nLw 410 nm | y = 0.6151x + 0.1962 | $R^2$ = 0.4005 |
| WCIS gains | nLw 410 nm | y = 0.6894x + 0.1915 | $R^2$ = 0.4213 |
| MOBY gains | nLw 443 nm | y = 0.8955x + 0.1248 | $R^2$ = 0.7199 |
| WCIS gains | nLw 443 nm | y = 0.96x + 0.0819 | $R^2$ = 0.7745 |
| MOBY gains | nLw 486 nm | y = 1.083x + 0.025 | $R^2$ = 0.9096 |
| WCIS gains | nLw 486 nm | y = 1.105x + 0.0215 | $R^2$ = 0.9317 |
| MOBY gains | nLw 551 nm | y = 1.0231x + 0.0263 | $R^2$ = 0.9612 |
| WCIS gains | nLw 551 nm | y = 1.0192x + 0.0087 | $R^2$ = 0.9671 |
| MOBY gains | nLw 671 nm | y = 0.8689x + 0.0141 | $R^2$ = 0.9337 |
| WCIS gains | nLw 671 nm | y = 0.8853x + 0.0389 | $R^2$ = 0.9433 |


ViCal Gain time series MOBY 2013 to April 2014
Lt_insitu/Lt_sat(671.0)
Lt_insitu/Lt_sat(410.0)
Lt_insitu/Lt_sat(443.0)
Lt_insitu/Lt_sat(486.0)
Lt_insitu/Lt_sat(551.0)
1.04
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
0.95
0.94
12/19/2012
2/7/2013
3/29/2013
5/18/2013
7/7/2013
8/26/2013
10/15/2013
12/4/2013
1/23/2014
3/14/2014
5/3/2014
6/22/2014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1.04
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
0.95
0.94
12/19/2012
2/7/2013
3/29/2013
5/18/2013
7/7/2013
8/26/2013
10/15/2013
12/4/2013
1/23/2014
3/14/2014
5/3/2014
6/22/2014

# GAINS from MOBY and WavCIS Sites

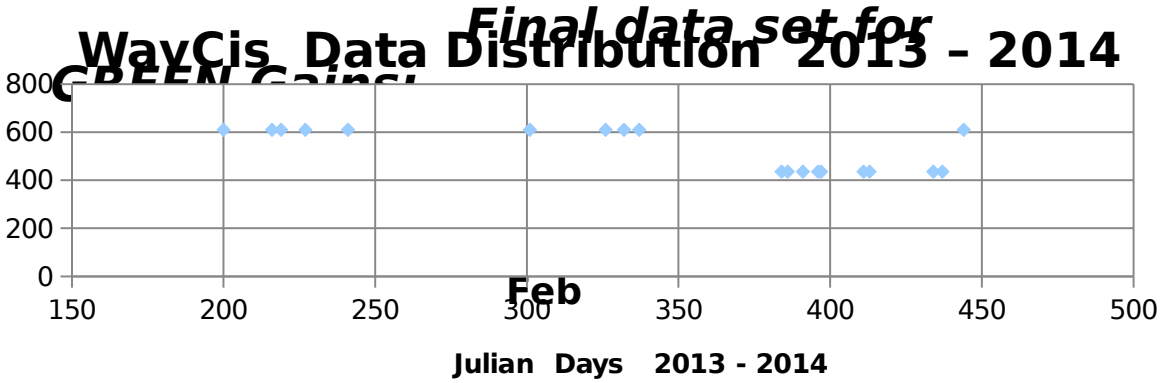
BLUE Water

MOBY – Marine Optical Buoy - Hawaii -
HAWAII - Homogenous water - Standard for Blue water
Gains from 25 Matchups points in - 2013

GREEN Water

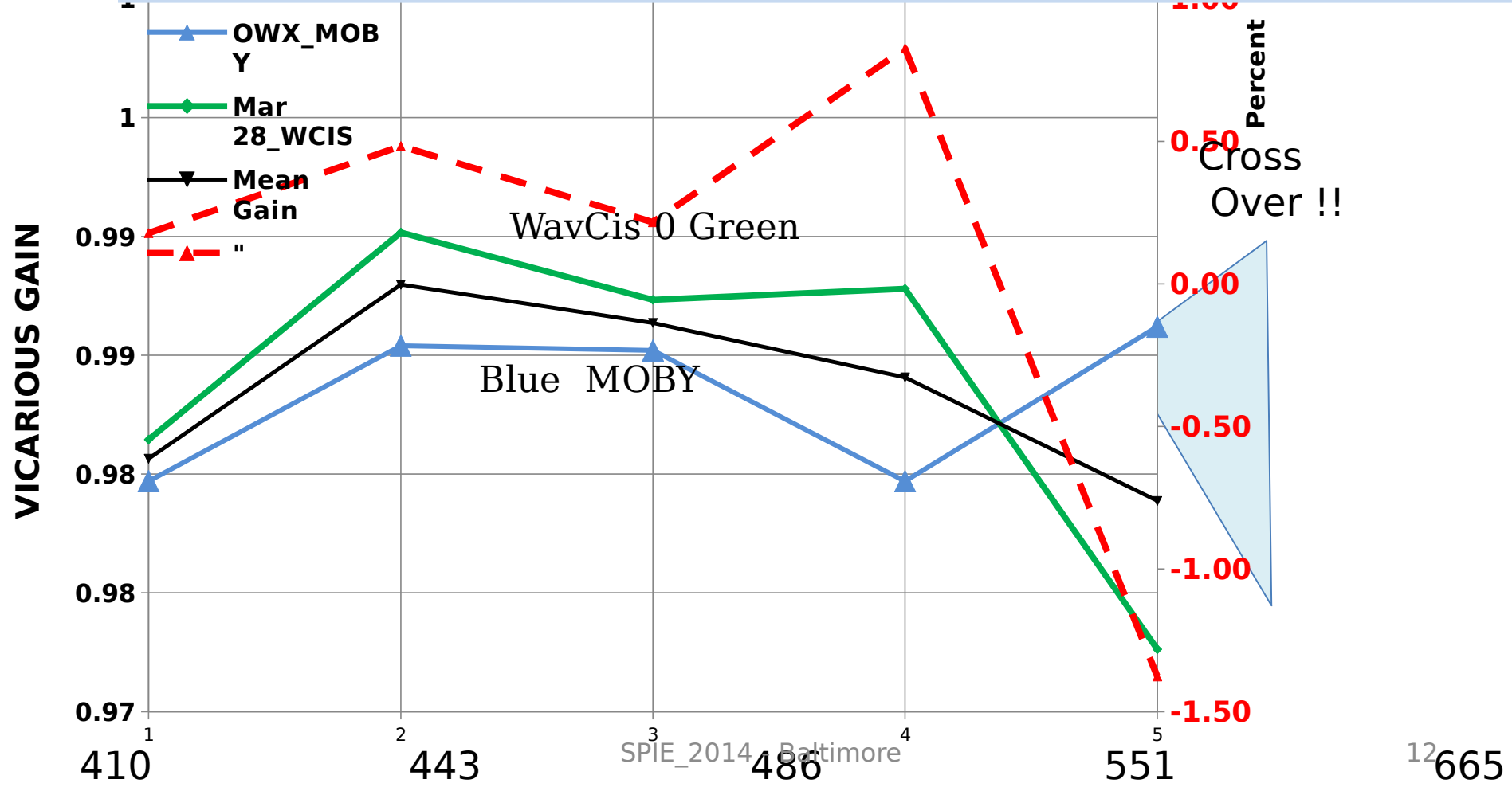
WAVCIS – AERONET - SeaPRISM - Gulf of Mexico
Gains from 21 points

Screening and constrainirts of the data outlined in:
Bowers et al Poster 9111-41

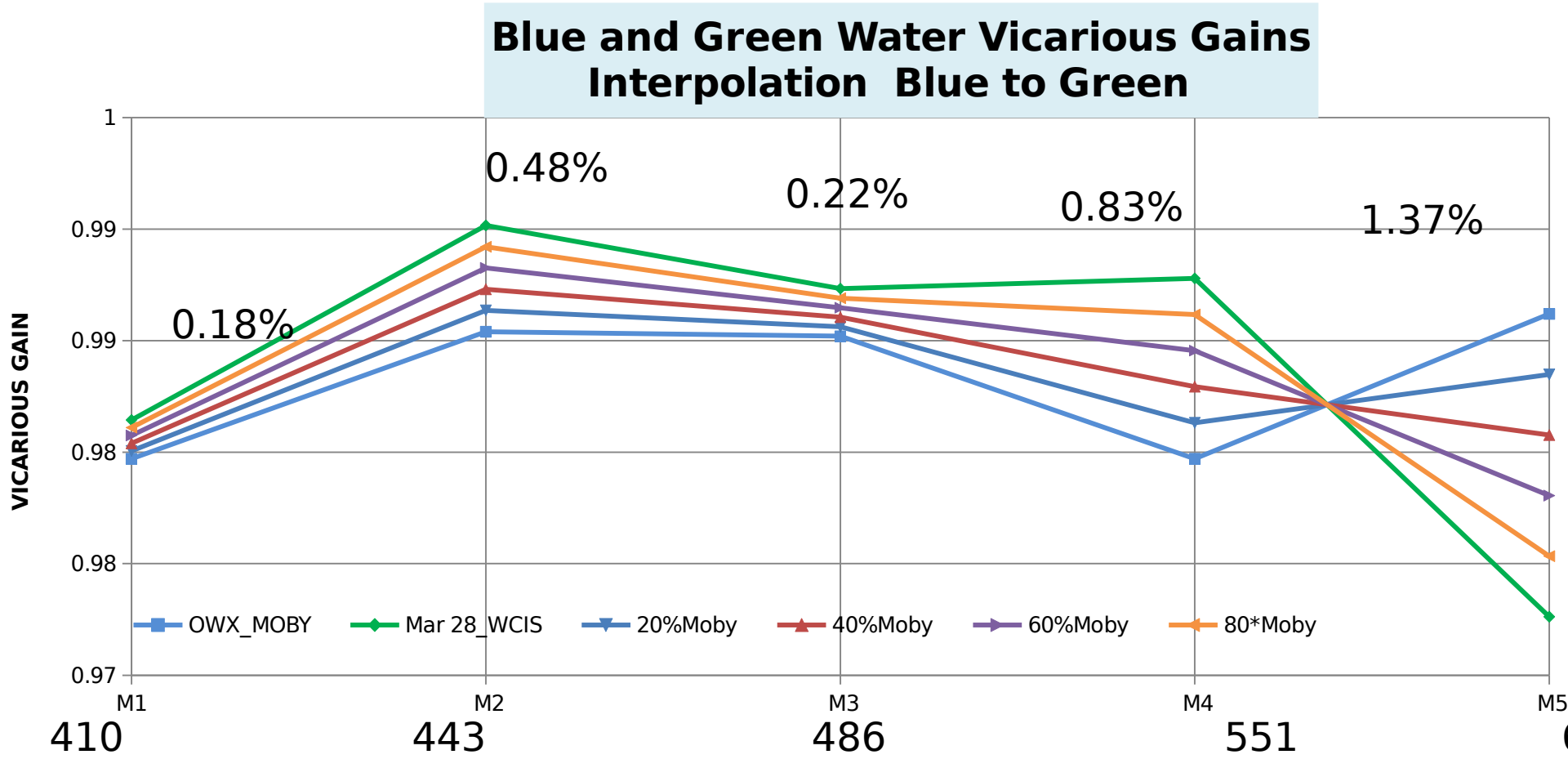


# Blue and Green Water Vicarious Gains
# July 2013 – March 2014

$$PD = 100 * \frac{GG-BG}{BG}$$



# Linear Extrapolation from Blue to Green Green




**How do these variations in the Gains Impact the Ocean color Products ?**

**an color products**

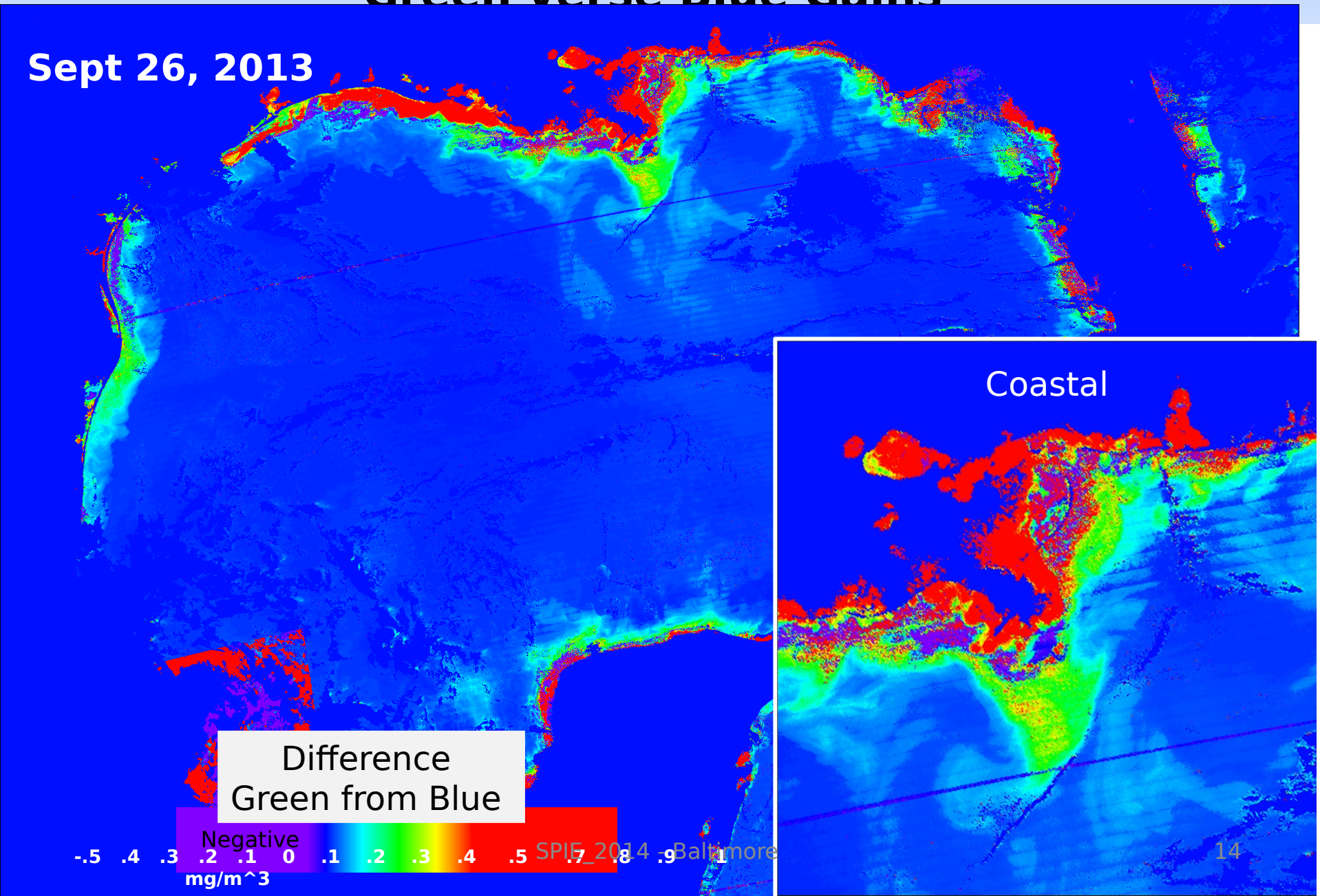
- **nLw**
- **Chlorophyll = m1/ m3 m2/m3**
- **Absorption and Backscattering**

**6 Ensembles GAINS**

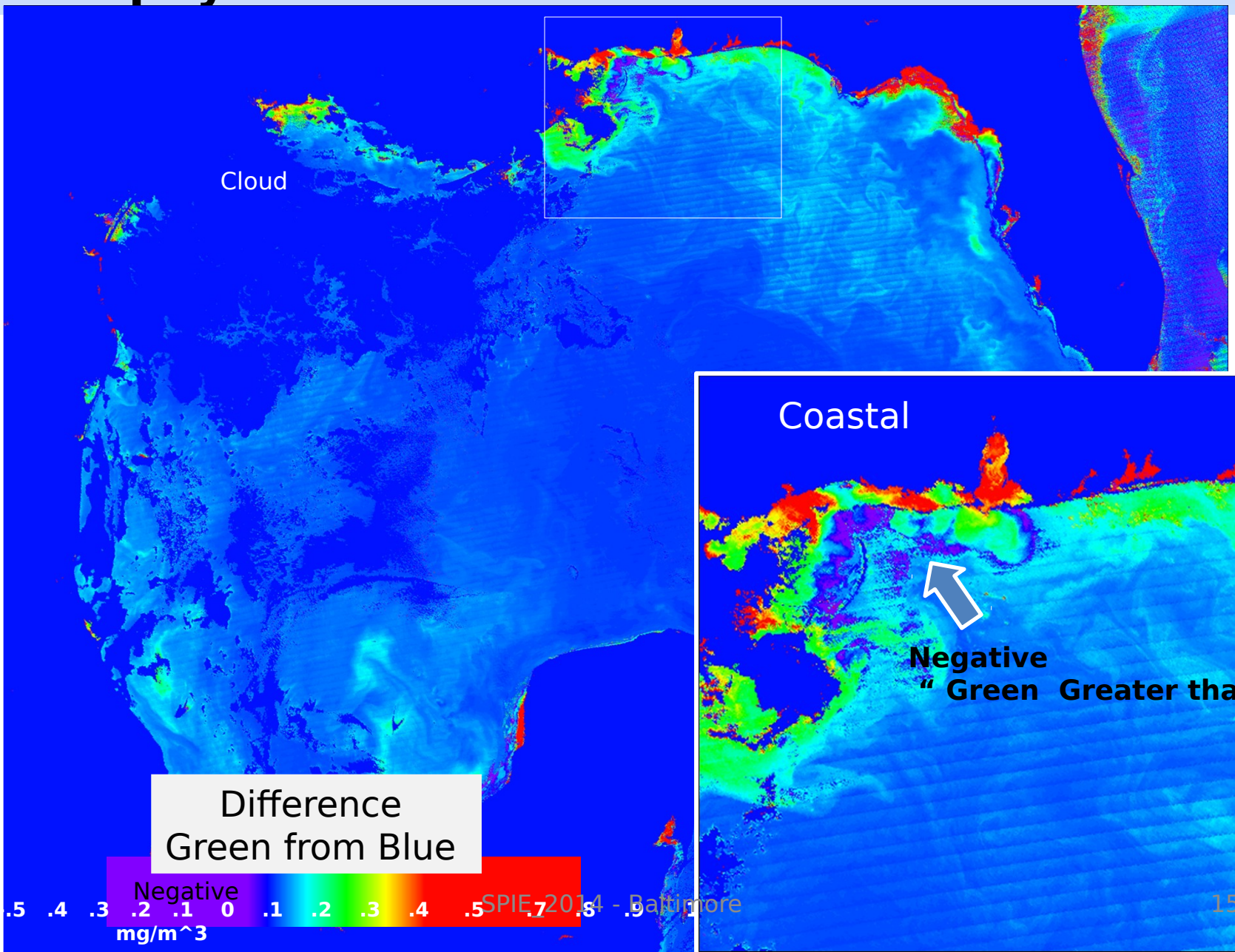
**1 2 3 4 5 6**

**BLUE , 20, 40, 60 , 80, 100% Green**

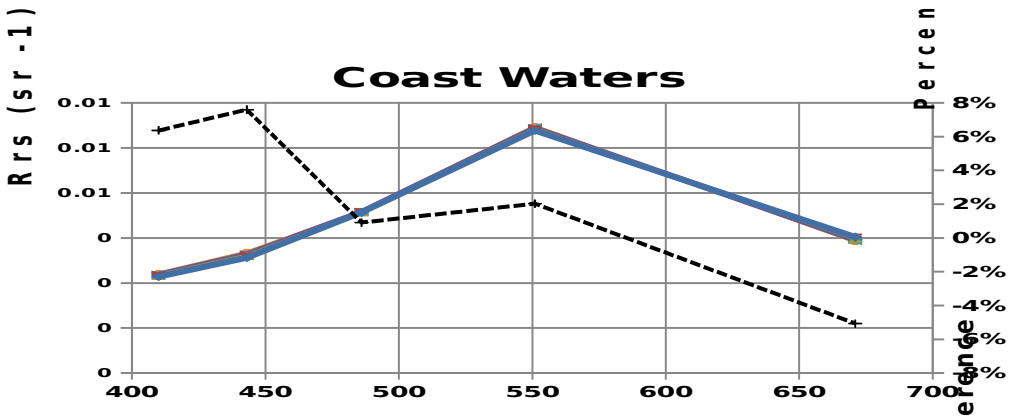
# Chlorophyll Difference resulting from Green verse Blue Gains

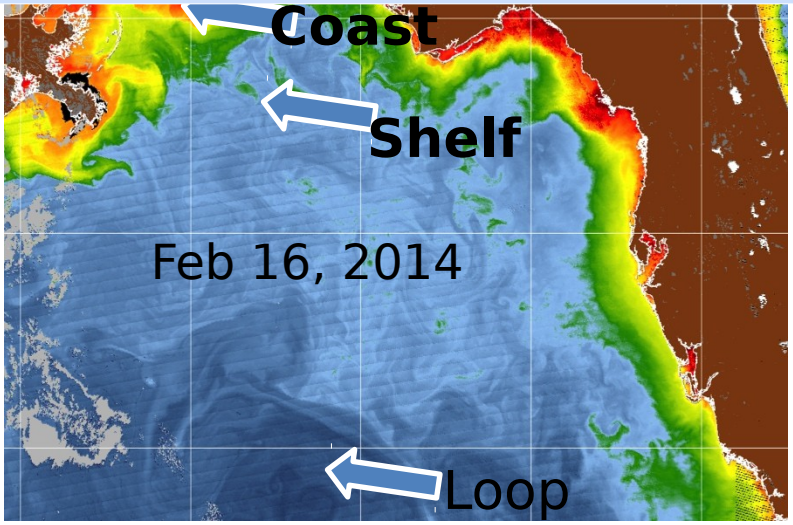


# Feb 16, 2013
# Chlorophyll Difference in Green verse Blue Gains

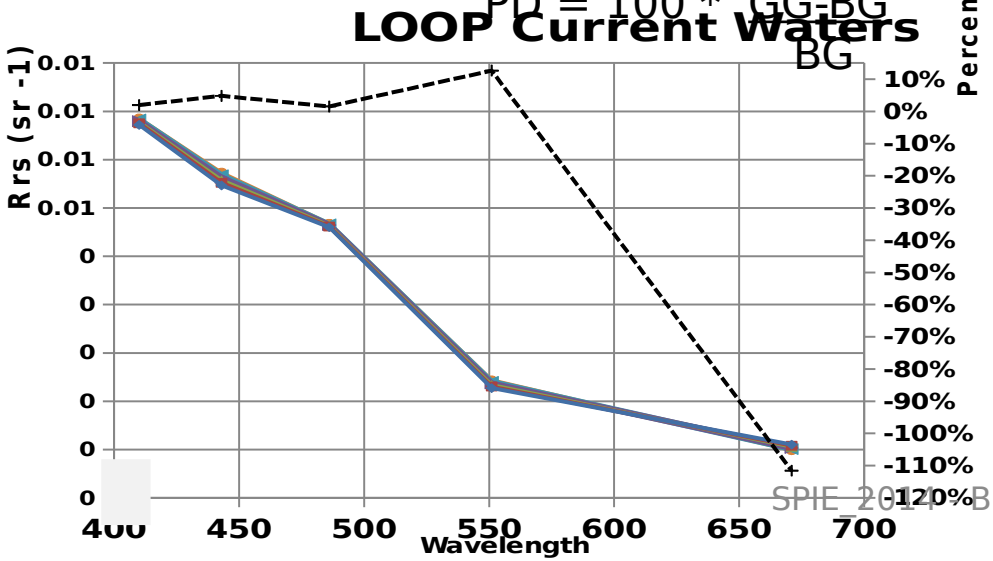


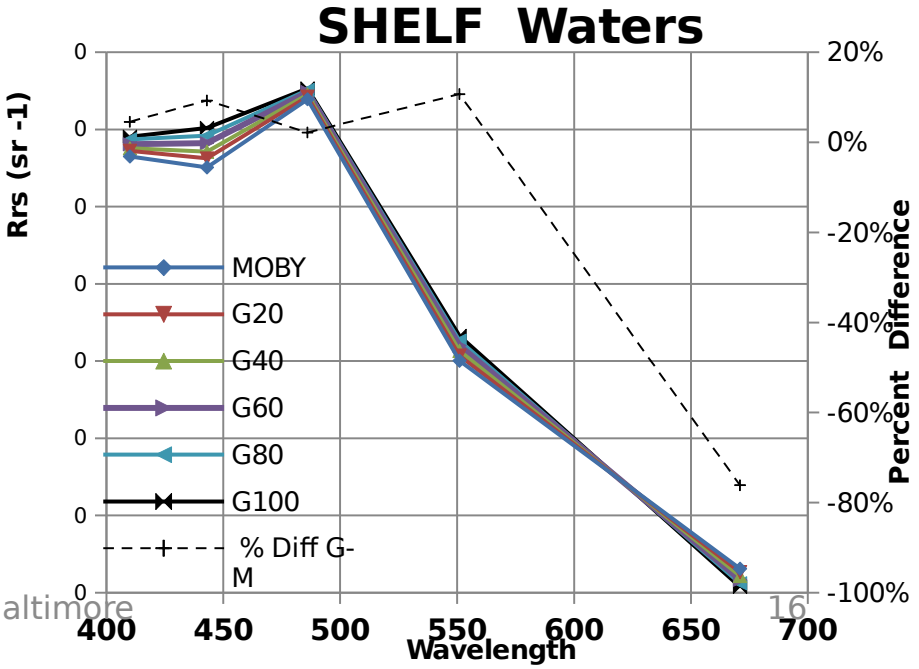
# Spectral Water Mass Changes - MOBY and WavCi Gains



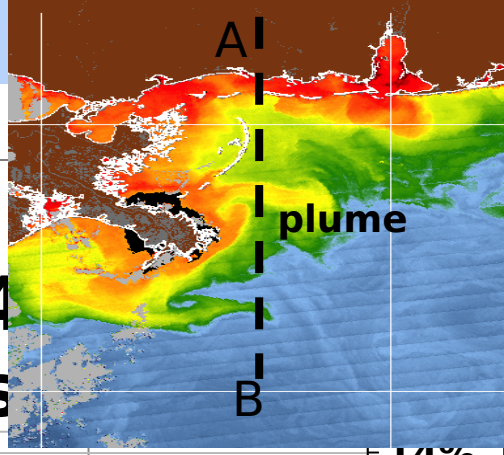




PD = 100 * GG-BG
BG



# Gain Impacts along Profile




## Feb 16 , 2014
## Chlor_a Trans

Chlor_a (mg ^ m-3)

10
1
0.1

% Difference WavCS MOBY

14%
12%
10%
8%
6%
4%
2%
0%

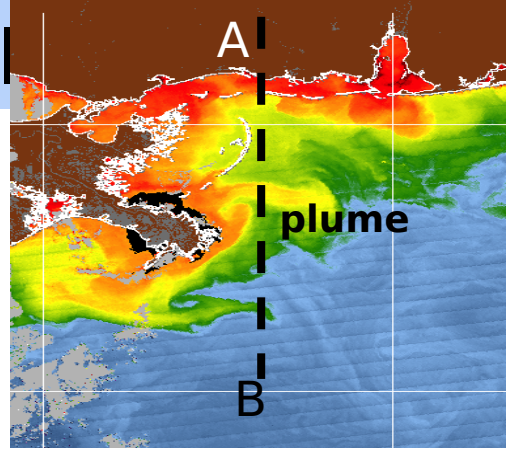
MOBY
20GG40

50 75 100 125 150 175 200

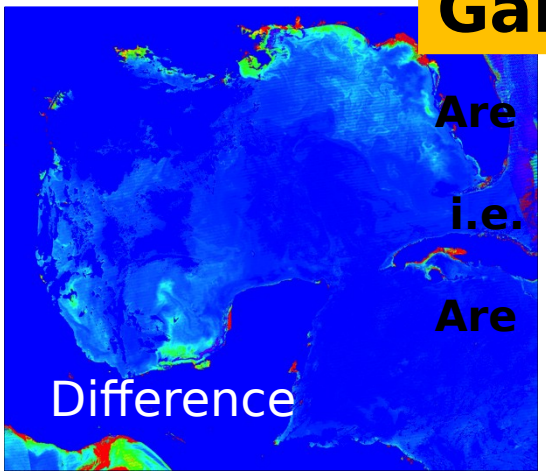
Distance (km)

A B

# Gain Impacts along Profil



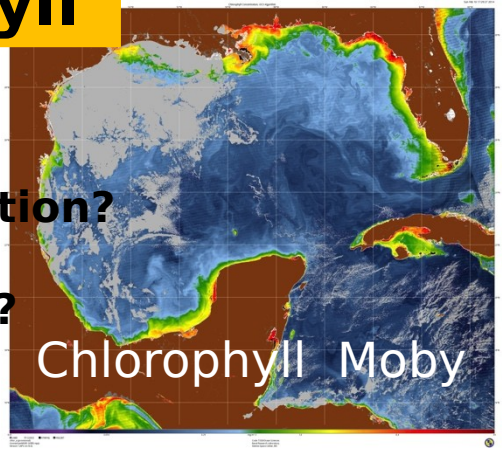
# Gain Impacts on Chlorophyll




**Are the Differences from the GAINS related to Concentration?**

**i.e. gains affect higher CHL concentration?**

**Are Difference regionally dependent ?**

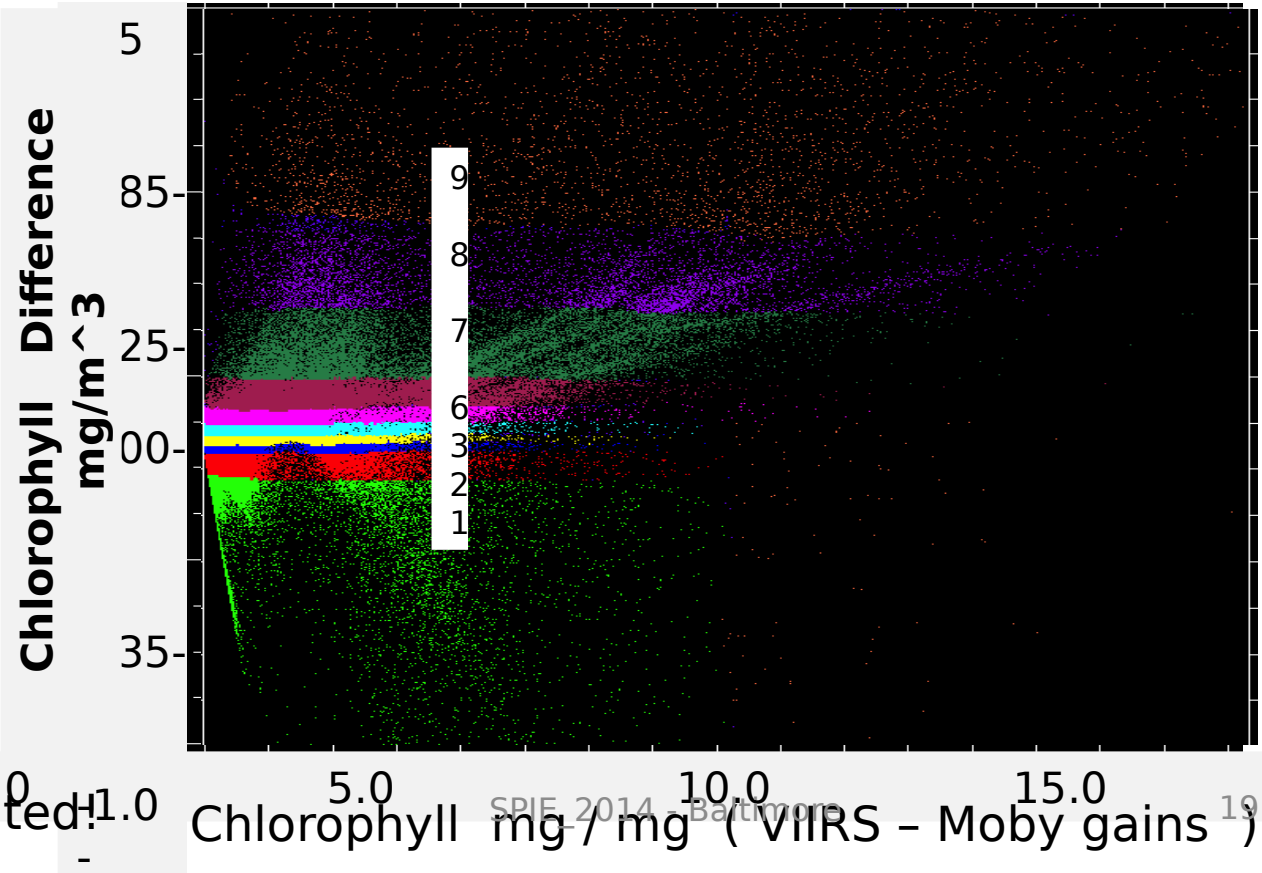



Scatterplot
Probability Density

Difference =
Green - MOBY

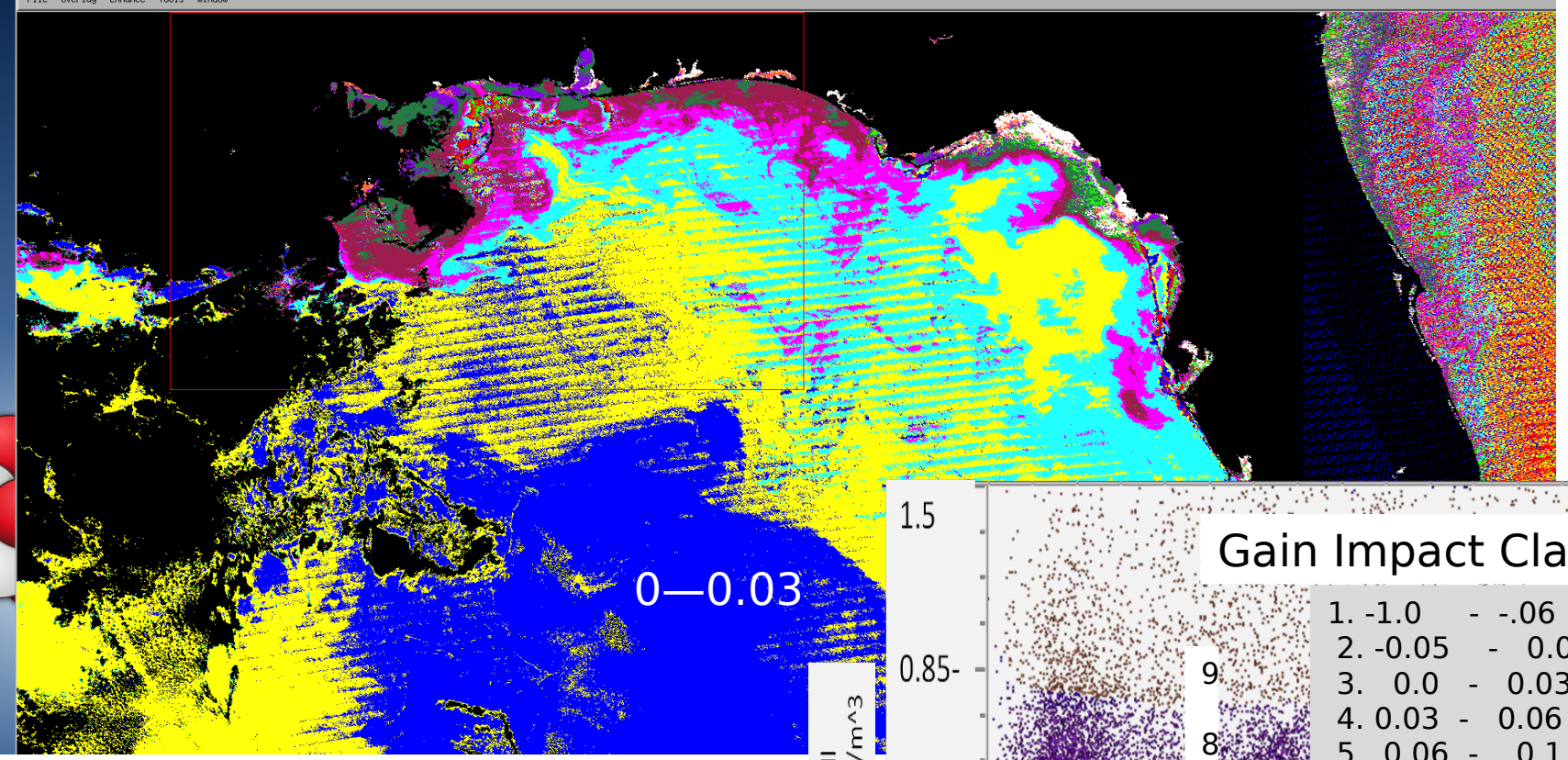
Gain Impact Classification

. -1.0 - -.06 = Green
. -0.05 - 0.0 = Red
. 0.0 - 0.03 = Blue
. 0.03 - 0.06 = Yellow
. 0.06 - 0.1 = Lt Blue
. 0.1 - 0.15 = Magenta
. 0.15 - 0.25 = Maroone
. 0.25 - 0.5 = Purple
. 0.75 - 1.5 = Coral




OT Concentration related!

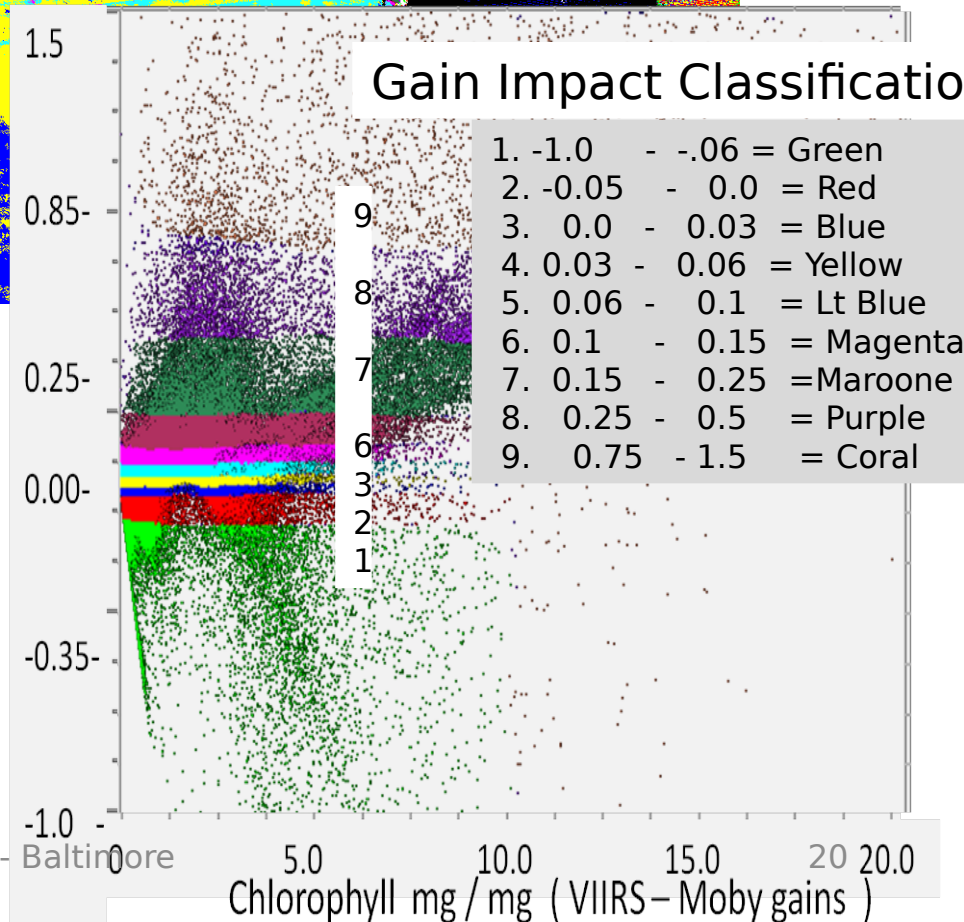
Chlorophyll mg / mg ( VIIRS – Moby gains )

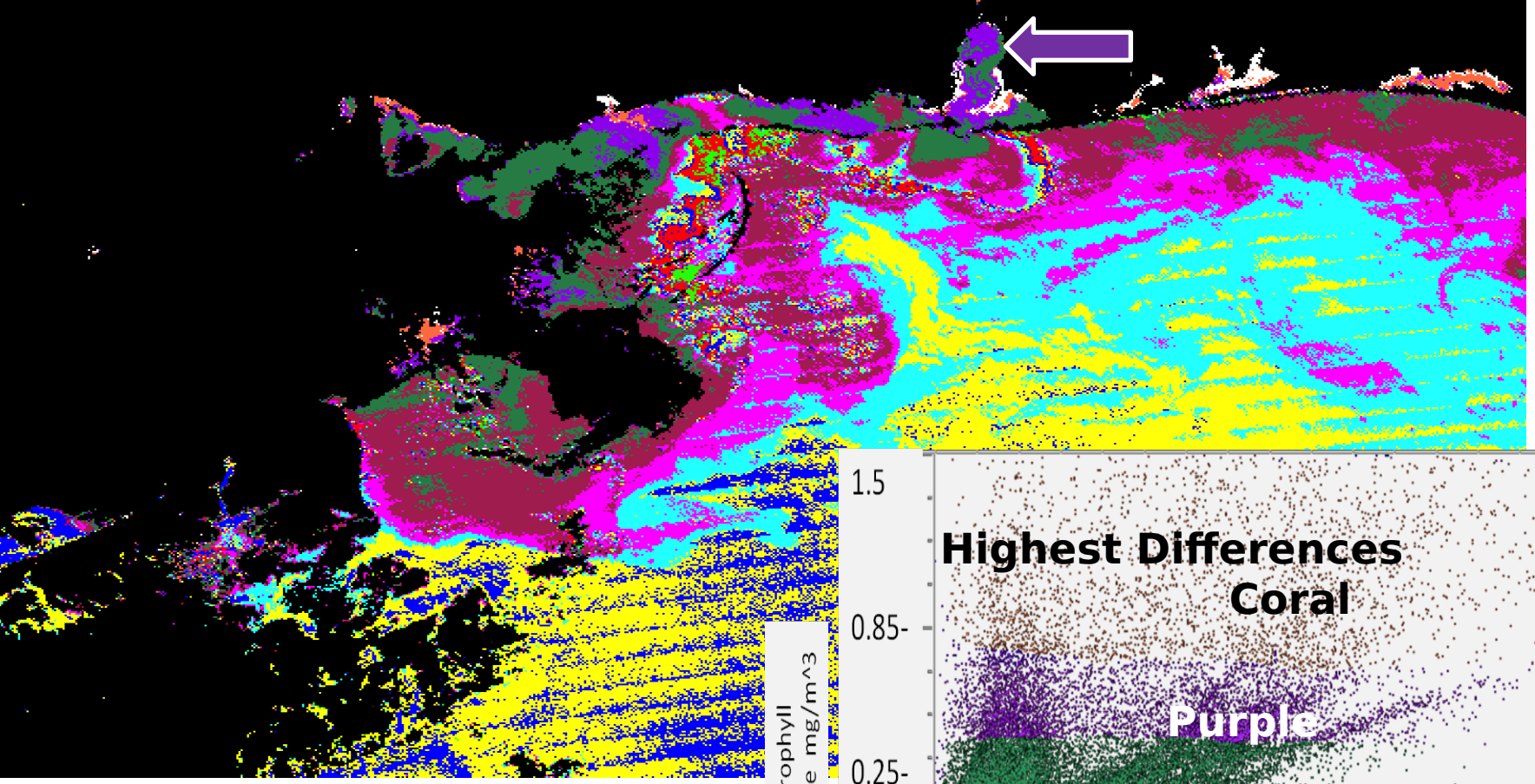


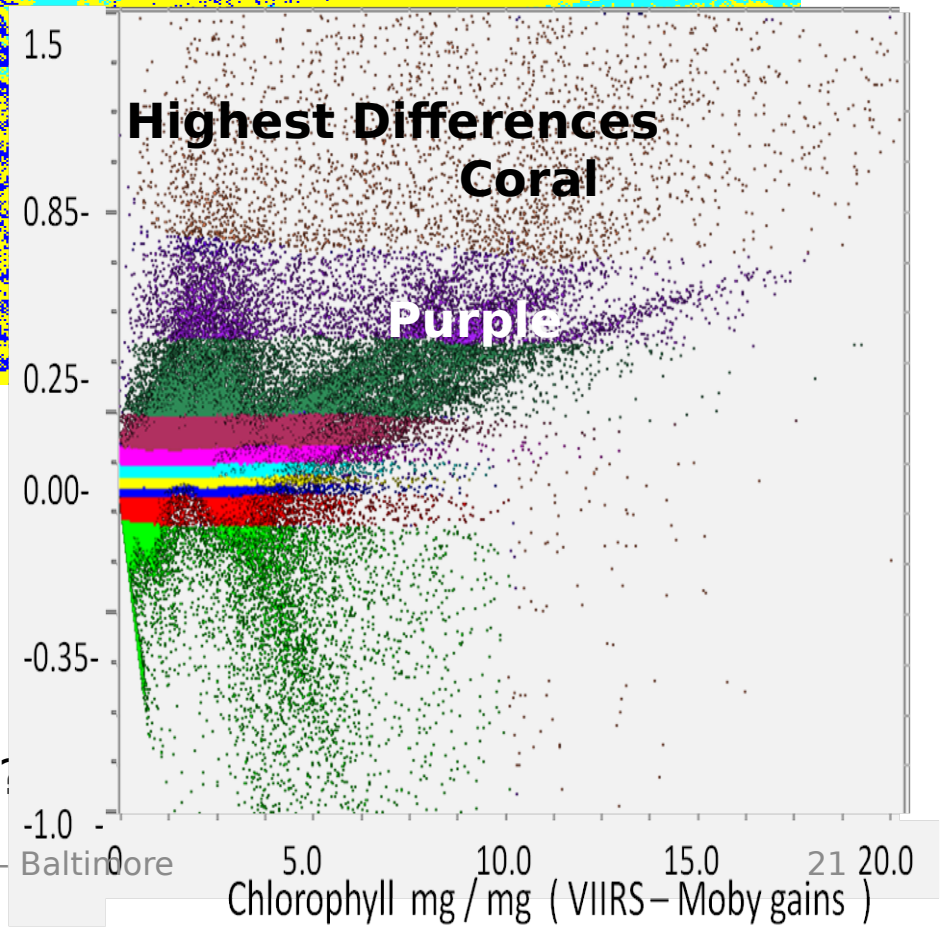

cation of where the Chlorophyll
ferences occur?

te the open Ocean Loop has
nimal differences -Blue 0- 0.03 mg/ mg

rgest Differences in coastal areas .





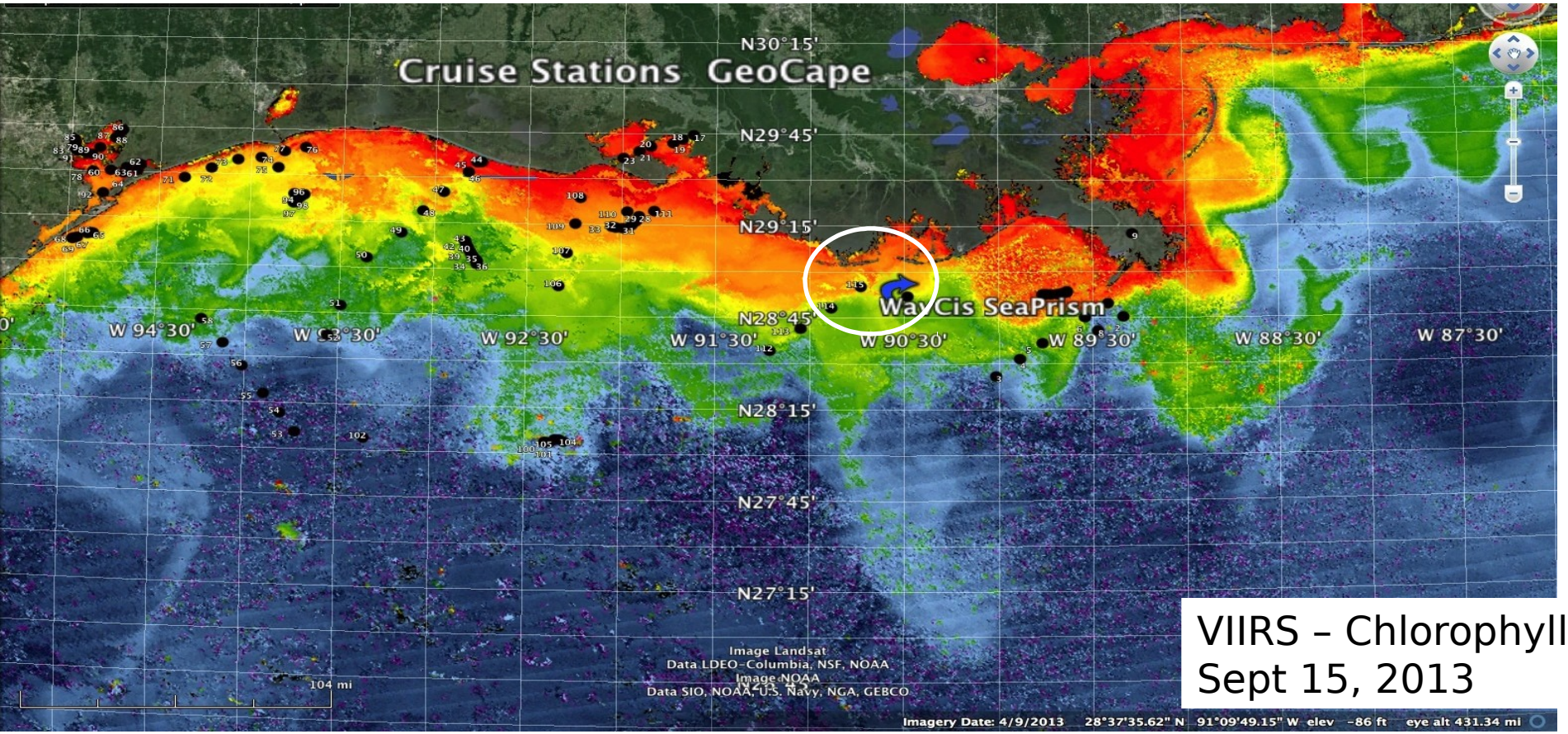



ocation of where the Chlorophyll
ifferences occur?

Largest Differences in Coastal waters.

legative Difference at shelf boundaries?

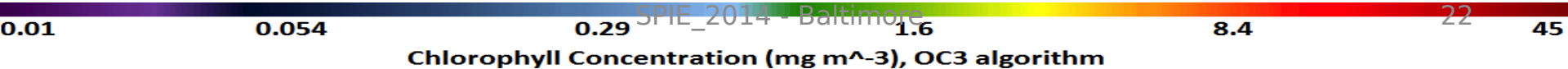
# Geo Cape comparisons of Blue and Green gains




VIIRS – Chlorophyll
Sept 15, 2013

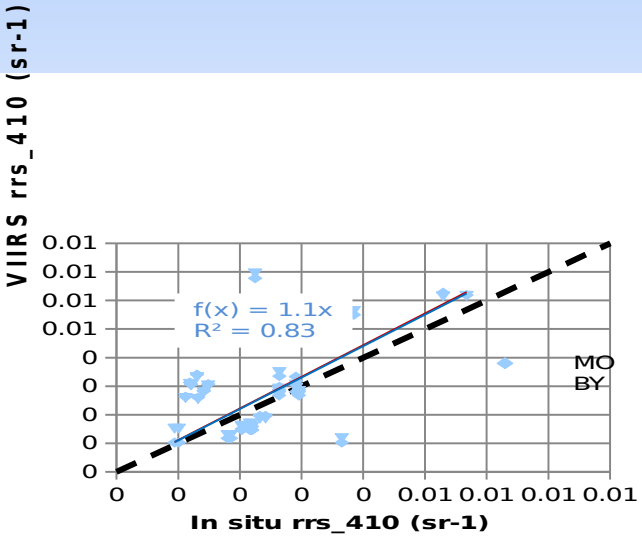
Location of the WavCis and the Green water Vicarious Gains

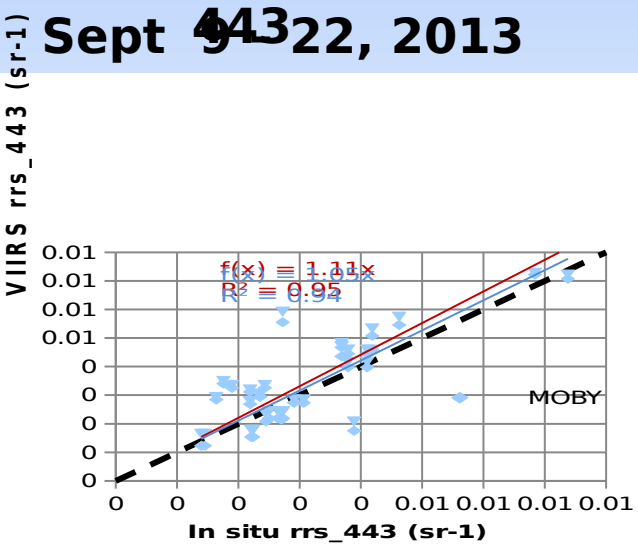
GeoCape Stations - 40 matchup

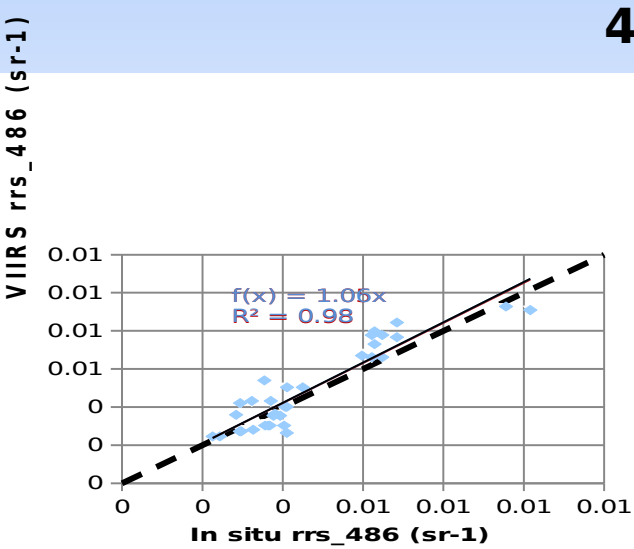


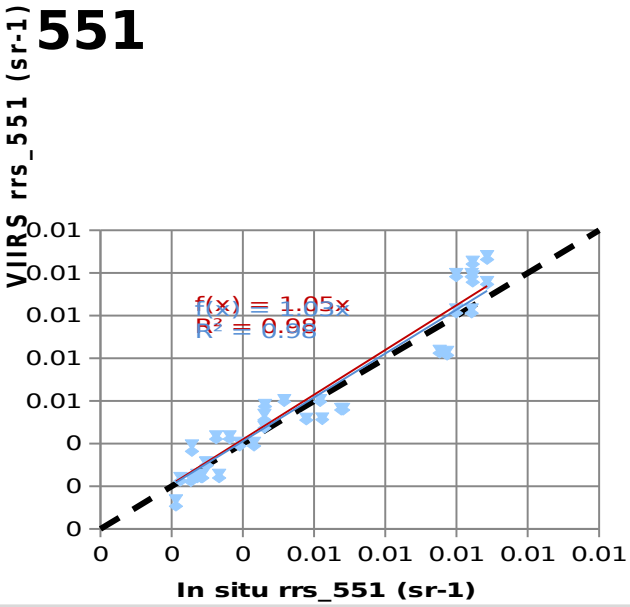
# Comparison Gains with the RRS Matchup - 30 stations

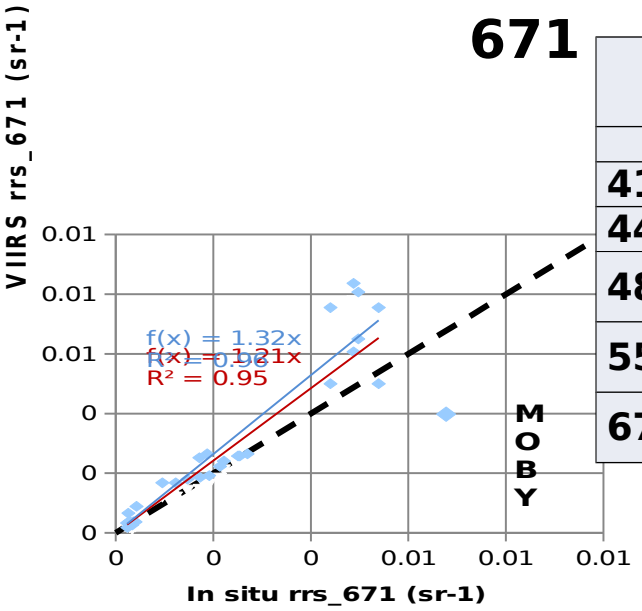
## Sept 9 - 22, 2013



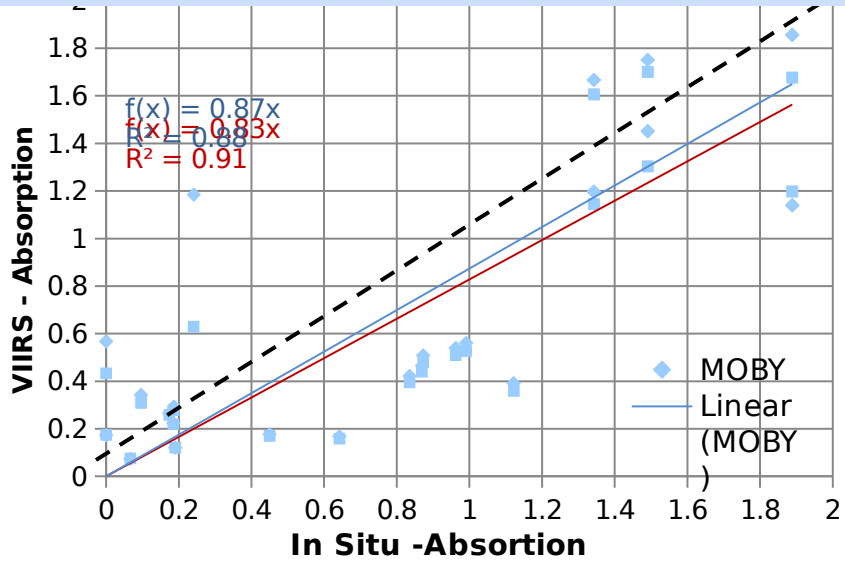



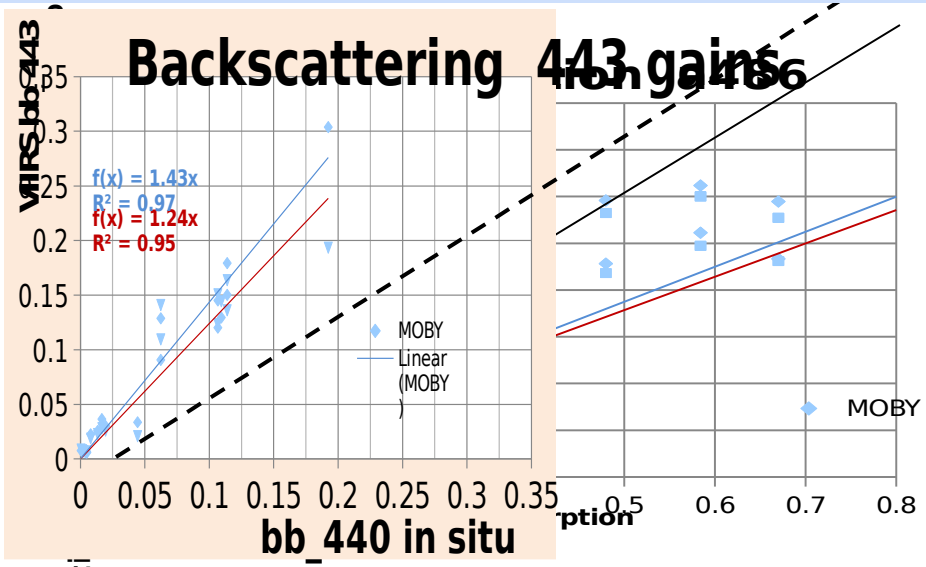

| | Moby (Blue) | | WavCis (Green) | |
|---|---|---|---|---|
| | R^2 | Slope | R^2 | Slope |
| **410** | 0.2541 | 1.099 | 0.2231 | 1.107 |
| **443** | 0.6605 | 1.054 | 0.6477 | 1.106 |
| **486** | 0.8456 | 1.0558 | 0.8478 | 1.0298 |
| **551** | 0.9306 | 1.0275 | 0.9307 | 1.0495 |
| **671** | 0.9184 | 1.3207 | 0.915 | 1.2109 |

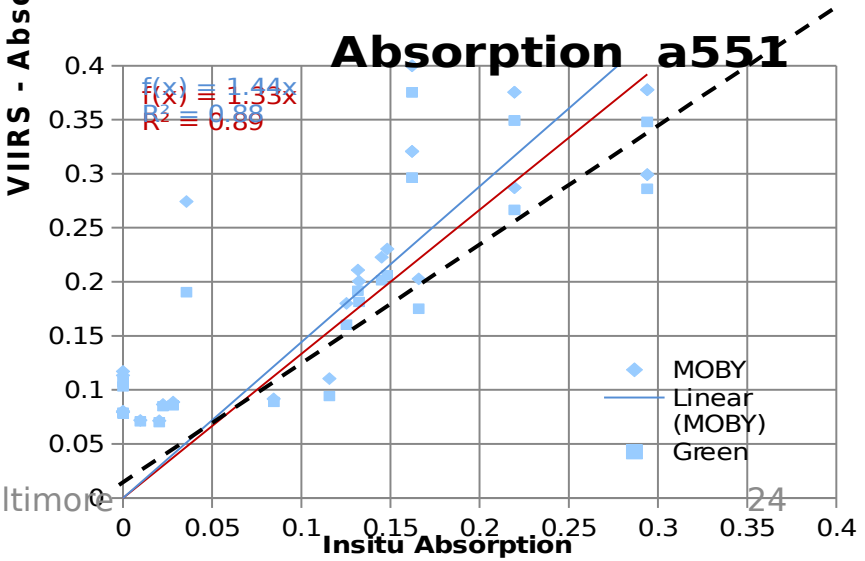
**Largest improvement in 671 nm with Slope - Not the regressio**

# Impact of Gains on in situ IOP- derived Product - Coastal Waters GEOCAPE




**1. Green Gain Closer to the One to One Line**



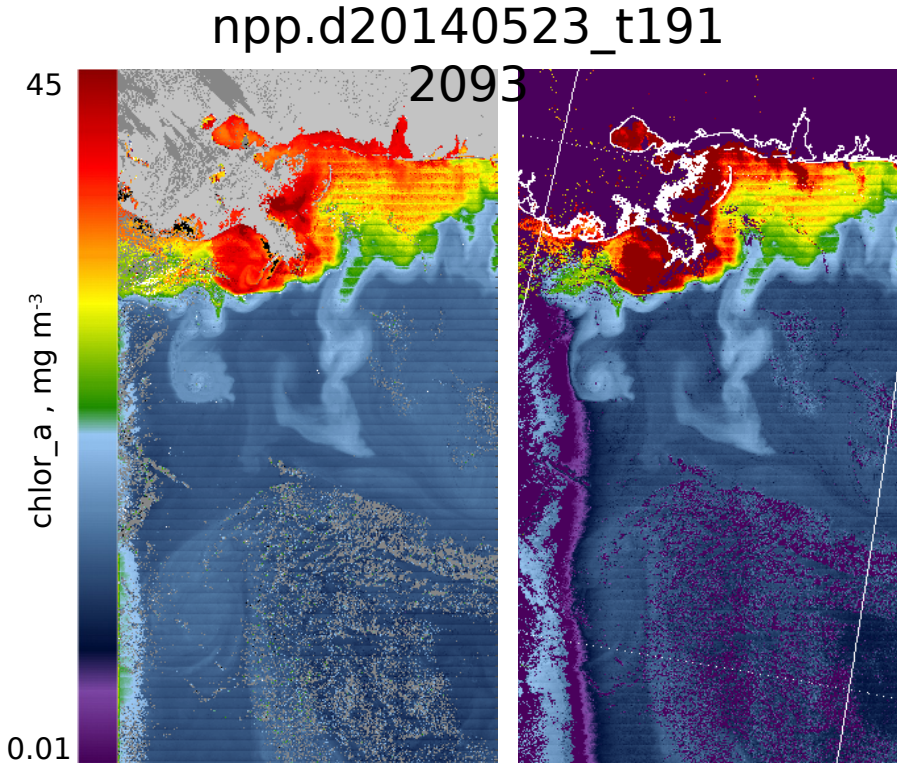
# Summary

- **Impact of the gains derived from Open water (MOBY) and Coastal water (WavCis) was defined for ocean products.**
- **Vicarious adjustment determined using coastal and open waters for 2013**

  **Using the MOBY and WavCIS AERONET Sites**
- **Spectral gain differences were small for the channels -**
  - **- largest in the 671 – ( red)**
- **Impact of the differences of Chlorophyll was in coastal waters and little Impact on open waters.**
- **The differences not linked directly to the concentrations but to the water mass coastal waters .**
- **Small spectral adjustments has impact on the color products.**
- **Can open ocean water site only be used for vicarious calibration**
- **Adjustments in gain at a coastal site impacts the coastal products.**

- **Future efforts will determine if other coastal sites have similar affect on the gains?**

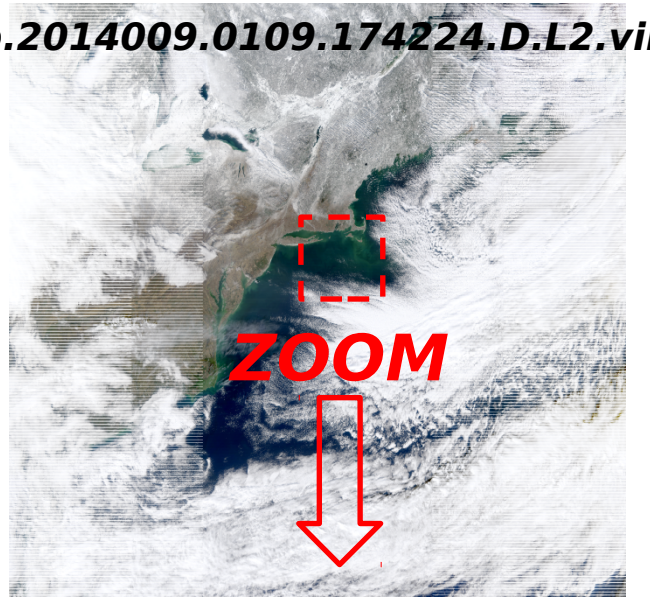
# SNPP - VIIRS Striping near nadir




l2gen / NASA

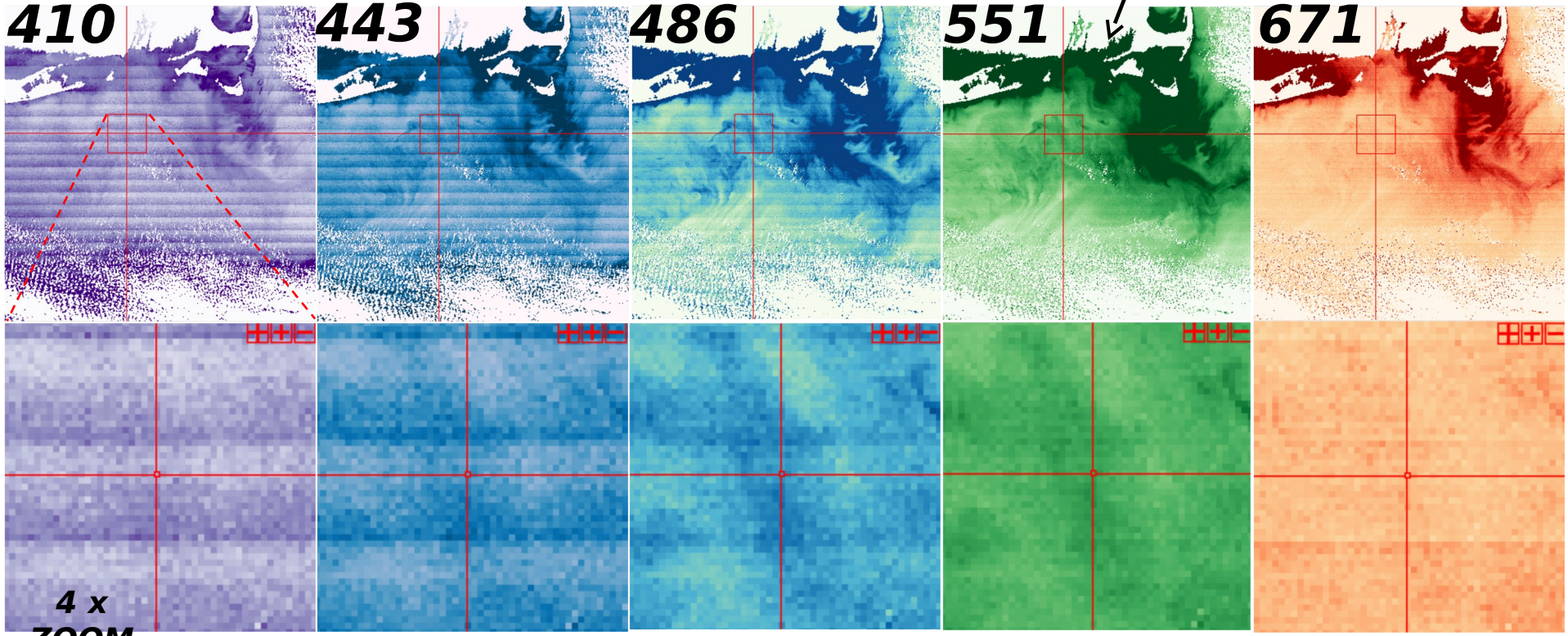
IDPS

- Periodicity in signal linked to striping near nadir
- Need to quantify impacts to Rrs / bio-optical products for various regions
- Identify channels with highest impact
- Identify source of the striping signal




# Spectral dependence of striping in coastal waters

Minimal striping in 551 channel

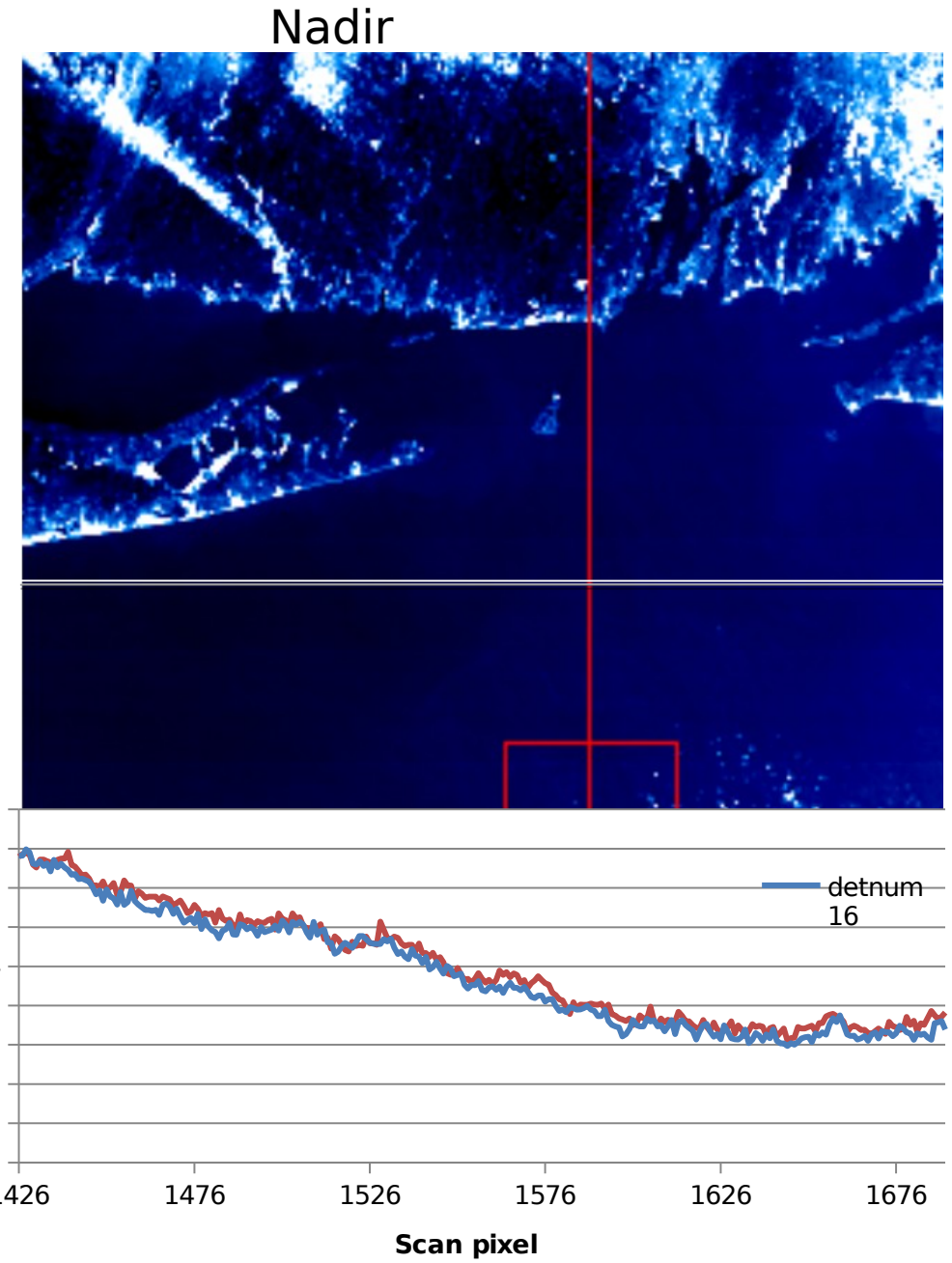


# Near-nadir Horizontal profile

## Lt_410

*Examining differences 2 detectors away (1.5 km separation)*

*Across section, there is an average 0.2 % difference between detector 16 and detector 2 from next scan*



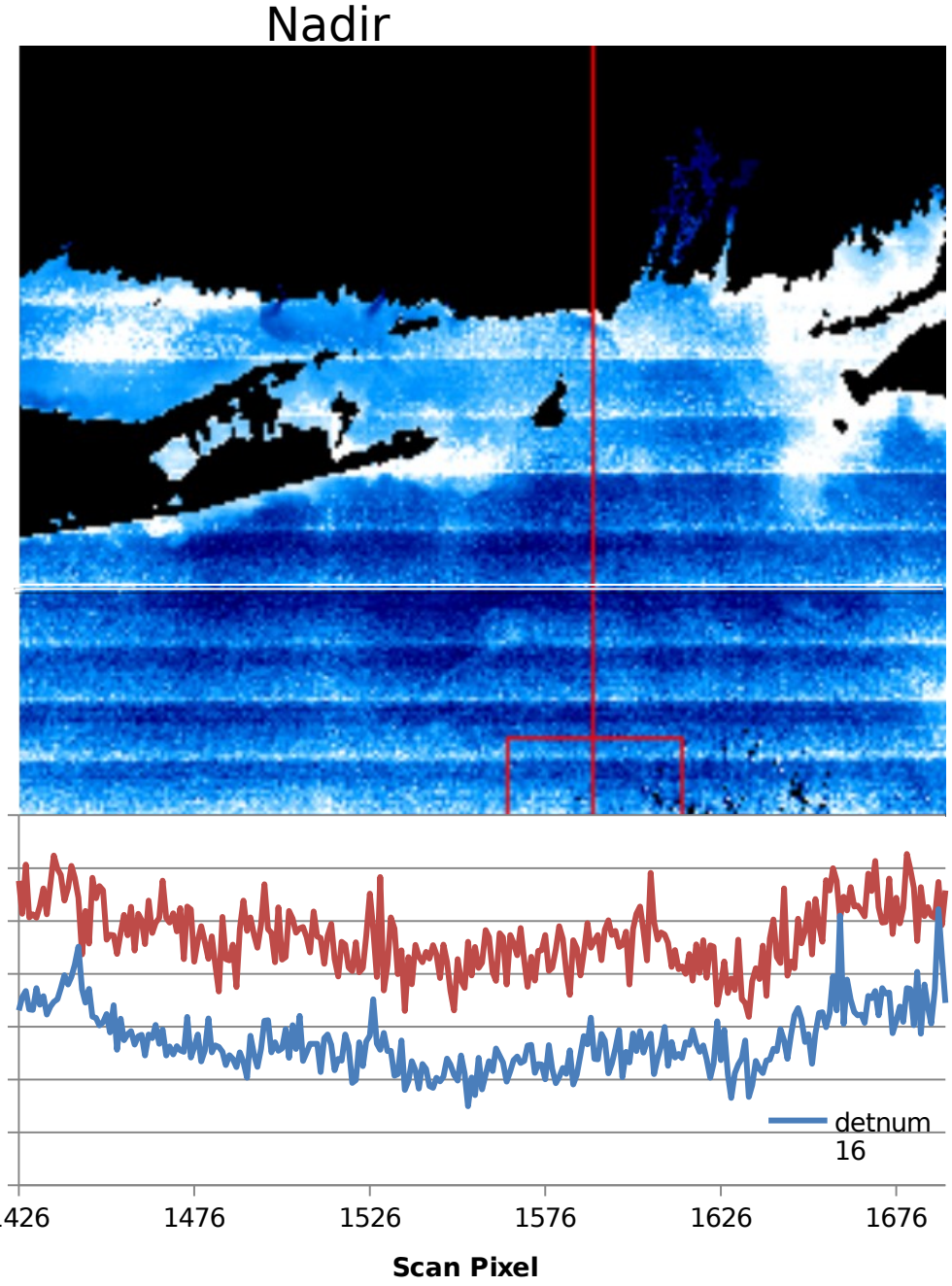
# Near-nadir Horizontal profile

## rrs_410

*Examining differences 2 detectors away (1.5 km separation)*

*Across section, there is an average 53 % difference between detector 16 and detector 2 from next scan*

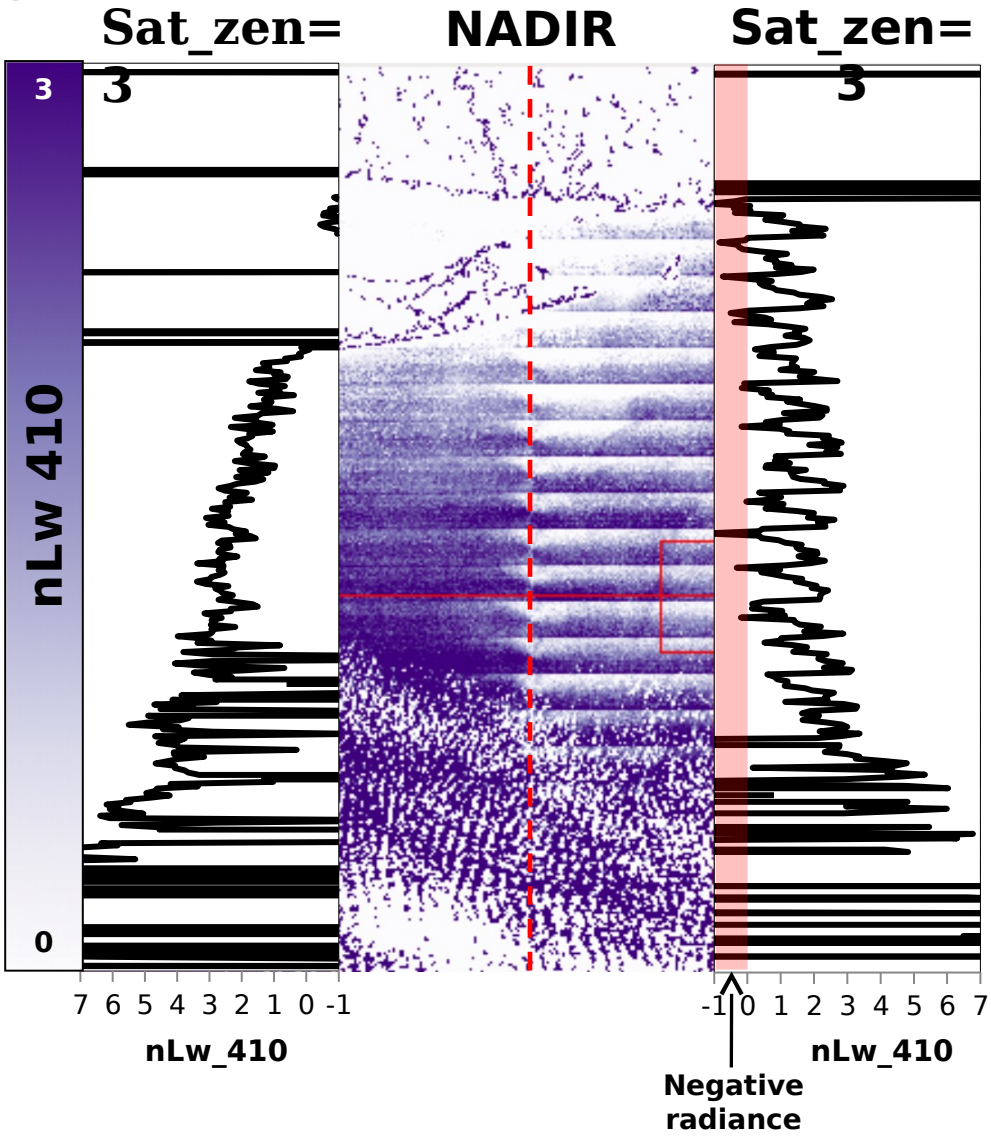
*21% diff for chlor_a*
*60% diff for a_410_qaa*



# *IDPS – nLw product*

***Normalized Water-leaving radiance at 410 nm (line)***

***(map shows nLw_410)***



# Summary and future directions

- Striping significantly affects Rrs and bio-optical products for VIIRS
- There is a regional difference in magnitude of error: coast (50%) v. blue waters (10%)
- Appears to be spectral dependence to striping signal (e.g. Striping 410 > 443 > 486 > 551)
- Need to discern impacts of detector response
- Currently investigating signal contribution from atmospheric components (using l2gen):
  - Rayleigh (Lr), aerosols (La), polarization (L_u, L_q, pol_corr), sensor geometry (senz, sena, solz, sola), etc.

# Cal – Val meeting update June 5

Stennis team

# Outline

- Constraints used in Matchups
  - MOBY , WavCIS
- Impact of Moby gains and Green gain on IDPS products
- VIIRS Striping issues

- Future Developments